

DESCRIPTION**"SPRING MEMBER FOR DISC-BRAKE CALIPERS AND DISC-BRAKE
CALIPER"**

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The present invention relates to a spring member for disc-brake calipers; in particular, the present invention relates to a spring member suitable for cooperating with disc-brake caliper pads so as to limit 10 their vibrations, particularly when they are not engaged in braking, as well as to a caliper comprising such a spring member.

As is known, owing to the tolerances between the plates of the pads and the respective housing spaces in 15 disc-brake calipers, the pads are subjected to movements, predominantly in axial and tangential directions, which very frequently set up vibrations that lead to annoying noise.

To prevent these problems, there are known 20 constructions of spring members which are interposed between the pads and the reaction shoulders of the calipers so as to exert a resilient force against the pads to prevent undesired movements thereof. However, these spring members nevertheless permit movements of 25 the pads which can give rise to the above-mentioned

vibrations and effective anchorage of the spring members to the caliper is not ensured.

The problem of the present invention is that of providing a spring member for disc-brake calipers which 5 overcomes the problems mentioned with reference to the prior art.

These problems and limitations are solved by a spring member for disc-brake calipers according to Claim 1.

10 Further embodiments of the spring member according to the invention are described in the subsequent claims.

Further characteristics and the advantages of the present invention will be understood better from the following description of a preferred and non-limiting 15 embodiment thereof, in which:

Figure 1 is a perspective view of a brake caliper according to the present invention, with parts separated,

20 Figure 2 is a general perspective view of some components of the caliper of Figure 1,

Figure 3 is a side view of the caliper of Figure 1 from the side indicated by the arrow III in Figure 2,

Figure 4 is a section taken on the line IV-IV of Figure 3 through the caliper of Figure 1, without pads,

25 Figure 5 is an enlarged view of a detail, indicated

V in Figure 3, of the caliper of Figure 1, in a configuration without the pads fitted,

Figure 6 is a view of the detail V of Figure 5 of the caliper of Figure 1, in a configuration with the 5 pads fitted,

Figure 7 is a view of a detail of the caliper of Figure 1, taken on the arrow VII of Figure 3,

Figure 8 is a section taken on the line VIII-VIII through the detail of Figure 7 of the caliper of Figure 10 1,

Figure 9 is a perspective view of the detail of Figure 8 of the caliper of Figure 1, and

Figures 10A-10D are different views of a spring member according to the invention.

15 Elements or parts of elements which are common to the embodiments described below will be indicated by the same reference numerals.

The term "axial direction X" means a direction substantially parallel to the axis of rotation of the 20 compatible brake disc.

The term "tangential direction Y" means a direction substantially perpendicular to the axial direction and parallel to the braking band of the compatible brake disc.

25 The term "radial direction Z" means a direction

substantially perpendicular to the axis of rotation of the brake disc compatible with the disc-brake caliper and perpendicular to the axial direction and the tangential direction.

5 With reference to the above-mentioned drawings, a disc-brake caliper unit for braking a brake disc, not shown, is generally indicated 4.

The caliper unit 4 is arranged astride a braking disc so as to extend in the region of at least a braking 10 band of the disc.

The present invention may be applied to a disc-brake caliper of any type, for example, a fixed or floating caliper formed as a single body or as two half-calipers. The following description will refer to a 15 floating caliper which represents a preferred but non-limiting example of the application of the present invention.

According to an embodiment relating to a floating caliper, the caliper unit comprises a fixed portion or 20 yoke 8 to be connected firmly to a caliper support, for example, a stub axle, and a movable portion or body 12 which is connected to the yoke 8 so as to be slidable axially relative thereto during braking.

Said movable portion 12 is connected to the fixed 25 portion 8, for example, by means of suitable rods, not

shown, on which the movable portion 12 slides.

At least one piston, for example, a single-acting piston, is housed in a respective cylinder 10 in the movable portion 12 and is guided for sliding so as to be 5 able to exert a thrust force on at least one pad 16 towards the braking surface of the brake disc.

The yoke 8 has a generally box-like structure and comprises two bridge portions 20A, 20B at opposite tangential ends 22A, 22B. The bridge portions 20A, 20B 10 are connected to one another by a pair of crosspieces 24 which extend substantially in the tangential direction Y.

The yoke 8 as a whole comprises a seat 28 suitable for housing a portion of brake disc on which a braking 15 force is exerted and comprises, in the region of each crosspiece 24, a space 32 for housing at least one pad 16.

The seat 28 preferably has a central plane R which is perpendicular to the axial direction X and can be 20 superimposed on a plane of symmetry of the compatible brake disc.

Each bridge portion 20A, 20B comprises two posts 36 which extend substantially perpendicularly relative to the crosspieces 24, to which they are connected at 25 respective first ends 37. Moreover, at respective

second ends 38 radially remote from the first ends 37, the posts 36 are joined together by two respective arches 40 which can be arranged astride the compatible brake disc.

5 Each post 36 comprises, on a reaction face or surface 42 facing towards the housing space 32, a reaction shoulder 44 for a pad 16, which reaction shoulder 44 is suitable for forming a stop for the pad 16, in particular during braking.

10 According to one embodiment, a protuberance 48 projects from the reaction surface 42 into the housing space 32, in the tangential direction Y, preferably in the vicinity of the second end 38 of the post 36.

The protuberance 48 is preferably delimited in the
15 radial direction Z by an upper surface 48' facing radially outwards, that is, away from the crosspieces 24, and by a lower surface 48'' which faces towards the crosspieces 24; the protuberance 48 is delimited tangentially by a vertical surface 48''' substantially
20 perpendicular to the upper and lower surfaces 48' and 48''. The upper and lower surfaces 48' and 48'' are preferably parallel to one another and arranged tangentially.

According to one embodiment, the post 36 has a
25 generally concave configuration facing towards the

housing space 32 in the vicinity of the first end 37.

The protuberance 48 constitutes a type of support projecting from each reaction shoulder 44. The protuberance 48 and the first end 37 of the post 36 together delimit a "C"-shaped portion 49 suitable for constituting a radial locating element for the pad 16.

Each arch 40 comprises a front surface 50 which, for example, is substantially flat and which faces towards the seat 28.

10 In a joining region between each arch 40 and the two respective posts 36 there are preferably two recesses 52, arranged substantially symmetrically with respect to the central plane R and facing the seat 28 for the compatible brake disc.

15 The caliper unit 4 comprises at least one pair of pads 16 which, according to one embodiment, are identical and axially opposed, that is, they are mounted in each housing space 32, on opposite sides of the compatible brake disc, facing the respective pistons or
20 thrust surfaces. The term "thrust surfaces" means those surfaces of movable parts which are remote from the cylinders and which, in floating calipers, can press the pads against the braking band.

Each pad 16 preferably comprises a support plate 60
25 for supporting a friction lining 62. Each support plate

60 is provided laterally and on opposite sides, in a tangential direction Y, with lateral edges 64 which constitute stop means for the pad and which are intended to abut the respective reaction shoulders 44 during
5 braking.

In the region of the lateral edges 64, the pads 16 preferably comprise appendages 68 suitable for being housed in the "C"-shaped portions 49.

A spring member 70 can advantageously be interposed
10 between the lateral edge 64 of a pad 16 and the reaction surfaces 42 of the caliper so as to act resiliently on the pad 16.

According to a preferred embodiment shown, for example, in Figures 10A-10D, the spring member 70
15 comprises two limbs 76 and a connecting arm 78 between the limbs 76.

Preferably, the spring member 70 has a plane of symmetry S so that, when it is in a fitted configuration in the caliper, the plane of symmetry S is superimposed
20 on the central plane R of the seat 28 and of the compatible brake disc so that the spring member 70 is mounted astride the brake disc.

Each of the limbs 76 can cooperate with the lateral edges 64 of the pad 16 and with a corresponding reaction
25 surface 42 of the fixed portion 8 so as to fix the

spring member 70 to the reaction surfaces 42 and to act resiliently on the pad 16.

In particular, each limb 76 comprises a 'U'-shaped portion 80 suitable for forming a connection with a protuberance 48 of the reaction surfaces 42. The 'U'-shaped portion 80 preferably has a substantially trapezoidal shape suitable for forming a coupling or engagement, preferably a snap-coupling or snap-engagement, with the protuberance 48.

The 'U'-shaped portion 80 can achieve a form fit with the corresponding protuberance 48 so as to ensure the correct location and fixing of the spring member 70 on the reaction surfaces 42.

According to one embodiment, the 'U'-shaped portion comprises a first, for example straight, section 82 which is suitable for interacting with the upper surface 48' of the protuberance 48 and is oriented substantially tangentially when the spring member 70 is in the fitted configuration.

The 'U'-shaped portion 80 comprises a second, for example straight, section 84 which is connected to the first section 82 and is inclined thereto so as to be inclined towards the housing space 32 and facing the vertical surface 48''' in a fitted configuration.

The 'U'-shaped portion 80 comprises a third, for

example straight, section 86 which is connected to the second section 84 and is substantially parallel to the first section 82 so as to interact with the lower surface 48'' of the protuberance 48.

5 The first section 82 preferably converges with the third section 86, in the direction away from the second section 84.

Preferably, the third section 86 is arranged parallel to the lower surface 48'', is in contact therewith, and has a tangential extent greater than that 10 of the lower surface 48'', that is, of the protuberance 48. A bearing portion 49' of the second section 84 thus comes into abutment with the lower surface 48'' whereas a projecting portion 49'' of the second section 84 15 projects tangentially from the protuberance 48 towards the housing space 32 so as to constitute an extension of the lower surface 48'' and a radial restraint for the pad.

The connecting arm 78 between the limbs 76 is 20 disposed in the region of the 'U'-shaped portion, in particular, in the region of the first sections 82 of two adjacent limbs 76.

In the region of the portion of the connecting arm 78 that is attached to the two limbs 76, each limb 76 25 preferably comprises a notch or recess 88 for separating

the connecting arm 78 from the first section 82 and permitting resilient relative bending between the connecting arm 78 and the first section 82 of each limb 76.

5 The connecting arm 78 advantageously comprises a thrust portion 90 having the function of a support which can come into abutment with an internal surface of a respective arch 40, that is, a surface facing towards the seat 28 for the compatible brake disc.

10 In particular, the thrust portion 90 can abut the internal surface of the arch 40 in a manner such as to form a restraint in relation to pivoting of the spring member 70 when it is acted on by the pads 16, particularly during braking.

15 In the vicinity of the thrust portion 90, the connecting arm 78 advantageously comprises two fingers 92 which are disposed on opposite sides of the plane of symmetry S, are arranged axially, and are suitable for ensuring the axial location and/or clamping of the
20 spring member 70.

In particular, the fingers 92 can cooperate with the recesses 52 of the fixed portion 8 so as to create a bilateral axial restraint for the spring member 70.

The fingers 92 may be inserted in the recesses 52
25 either with a force fit or with slight clearance.

Each limb 76 of the spring member 70 further comprises a first resilient portion 96 which extends substantially in the radial direction Z from a first connection end 97 to a second connection end 98 and can act on the pad tangentially.

The first connection end 97 of the first resilient portion 96 is operatively connected to the 'U'-shaped portion, in particular, to the third section 86.

In one embodiment, the first resilient portion 96 is substantially straight and is inclined so that, when the spring member 70 is in the fitted configuration on the reaction surfaces 42, the first connection end 97 is in contact with the reaction shoulders 44 and the second connection end 98 is arranged further towards the interior of the housing space 32 than the first connection end in the tangential direction.

In other words, the first resilient portion 96 is inclined at an acute angle of less than 90 sexagesimal degrees to the third section 86 of the 'U'-shaped portion 80.

The spring member 70 further comprises a second resilient portion 100 which extends substantially in a tangential direction Y, is operatively connected to the first resilient portion 96 in the region of the second connection end 98, and can act on the pad 16 in a radial

direction Z.

The second resilient portion 100 is connected to and projects from the first resilient portion 96.

In particular, the second resilient portion 100 is
5 inclined to the first resilient portion 96 at an angle
of less than 90 sexagesimal degrees.

In other words, the free end of the second
resilient portion 100 is arranged radially further out,
that is, away from the crosspieces 24, than the end of
10 the second resilient portion 100 which is connected to
the first resilient portion 96.

The first resilient portion 96 and the second
resilient portion 100 form a single body projecting from
the first connection end 97 of the first resilient
portion 96 so that, when the spring member 70 and the
15 respective pad 16 are in a fitted configuration in the
housing space 32, the pad 16 is acted on resiliently by
the spring member both in a radial direction Z and in a
tangential direction Y, whether or not a braking force
20 is being applied.

The spring member 70 advantageously comprises a
plurality of lead-in tabs 112 for facilitating the axial
insertion of the pads 16 in the respective housing
spaces 32.

25 In particular, the lead-in tabs 112 are oriented

substantially axially away from the plane of symmetry S of the spring member 70.

According to one embodiment, the lead-in tabs 112 are arranged along outer lateral edges of the limbs 76, 5 that is, edges remote from the plane of symmetry S.

The lead-in tabs 112 are preferably arranged along the third section 86 of the 'U'-shaped portion 80 and along the first and second resilient portions 96, 100.

The fitting of the spring members 70 according to 10 the invention and of the pads 16 on the fixed portion 8 of a disc-brake caliper will now be described.

In a disc-brake caliper without pads 16, the spring member 70 is moved up to the protuberances 48 of the reaction surfaces 42 so as to fit the 'U'-shaped 15 portions 80 of the spring member 70 onto the protuberances 48 with a snap-coupling and to fit the fingers 92 in the respective notches or recesses 88.

A spring member 70 is mounted on the reaction surfaces 42 of each of the two bridge portions 20A, 20B.

20 After the spring members 70 have been mounted on opposed reaction surfaces 42, each spring member 70 has the first and second resilient portions, which constitute a single body, substantially pivoted towards the housing space relative to the first connection end 25 97 of the first resilient portion 96, as shown in Figure

5.

The pads 16 are then mounted by being inserted axially towards the central plane R, that is, by pushing the pads axially from the exterior of the caliper 5 towards the respective housing spaces; during the insertion stage, the pads 16 are guided by the lead-in tabs 112.

After the pads 16 have been mounted, the spring members 70 are preloaded both radially and tangentially. 10 In particular, the first and second resilient portions 96, 100, constituting a single cantilevered body, pivot about a fulcrum at the first connection end 97 of the first resilient portion 96.

The effect of this pivoting is to move the single 15 cantilevered body towards the reaction shoulders 44, as shown in Figure 6. As a result, the pads 16 are preloaded by the spring members 70 both radially and tangentially.

During braking, that spring member 70 which, on the 20 basis of the direction of rotation of the brake disc, receives a substantially tangential thrust from the support plates 60 of the pads 16, is further deformed until it comes into abutment with the reaction shoulders 44 of the caliper, whilst the opposite spring member 25 pivots tangentially towards the housing space 32, that

is, reduces the tangential preloading.

Upon completion of the braking stage, the spring members reposition the pad in the starting position, keeping it preloaded both radially and tangentially and 5 preventing the setting-up of vibratory phenomena.

As can be appreciated from the foregoing description, the spring member of the present invention overcomes the problems of spring members of the prior art.

10 In particular, the spring member described prevents undesired vibrations of the pads and of the caliper thereby.

In fact, after the pads have been mounted in their seats, they are preloaded both tangentially and radially 15 and any free movements inside the respective housing spaces, in particular during non-braking stages, are thus eliminated.

Moreover, the devices for anchoring the spring members to the caliper are situated in portions of the 20 spring member which are not working portions since they do not exert a resilient thrust on the pad. The devices themselves are therefore more secure in relation to possible slipping-out of the spring member and the respective fixing surfaces or portions of the caliper 25 body are not marked or damaged by rubbing against

movable parts of the spring member.

In order to satisfy contingent and specific requirements, a person skilled in the art will be able to apply to the above-described spring members many modifications and variations all of which, however, are included within the scope of the invention as defined by the appended claims.